A Fuel Efficiency Standard for Light-Duty Vehicles in Australia

Review of and input to the Consultation Paper
The Fuel Efficiency Standard –
Cleaner, Cheaper to Run Cars for Australia

Transport Emission Energy Research

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Date: 30 May 2023

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The research presented in this report is independent and has not been funded by an external organisation.

1. Introduction

Transport Energy/Emission Research (TER) has reviewed the consultation paper 'Fuel Efficiency Standard – Cleaner, Cheaper to Run Cars for Australia'[1], dated 19 April 2023 and recommends a rapid adoption of this standard, but after careful consideration and design.

The implementation of a Fuel Efficiency Standard (FES) is an important and overdue step towards a more sustainable future in the Australian road transport sector. However, implementation requires careful consideration of the details, which can 'make or break' a successful outcome. TER therefore highlights a number of gaps and risks in this brief report in relation to the FES, underpinned by the latest scientific research. It should be noted that this is not an exhaustive analysis and more can be said about this topic.

TER recommends that the points raised in this submission are considered in the creation of the new Australian fuel efficiency standard. Not doing so could undermine real reductions in fuel consumption and greenhouse gas (GHG) emissions from the transport sector, imposing more (damage) costs on society and the environment.

This submission focuses on fuel efficiency and GHG emissions. There are broader public benefits of reduced fossil fuel consumption and reduced energy use in transport in general. This includes reduced air pollution and associated health impacts[2] and improved energy security.

The Consultation paper mentions that the Department will undertake further bilateral and roundtable consultations with key stakeholders. TER suggests:

1. Transparency of the FES development process to the general public.
2. Further consultation with independent experts on the FES.

It is TER's mission support the transition from fossil-fuelled to smart, clean, zero emission transport, and as such TER would like to be involved in further consultations regarding the FES.[3]

A more detailed discussion follows in the remainder of this report. Where relevant, TER comments are summarised to answer specific questions raised in the consultation paper using this format:

Consultation paper question - …

[1] https://www.infrastructure.gov.au/have-your-say/fuel-efficiency-standard-cleaner-and-cheaper-run-cars-australia.

[2] For instance: https://www.unimelb.edu.au/__data/assets/pdf_file/0006/4498161/Expert-Position-Statement_Vehicle-emissions_FINAL.pdf.

[3] TER has contractual arrangements in place with well-respected transport emission experts in Australia, Europe and the United States and can form an international team to support the Government and to provide advice or review work that is independent, impartial and evidence-based.

2. The Australian FES in an international context

Australia needs real and rapid reductions in greenhouse gas emissions from the transport sector over the coming decades to start addressing increasingly severe climate change impacts.

Fuel efficiency and CO_2 emission standards can play a role here. Both fuel efficiency and CO_2 emission standards are dealing with approximately the same thing: reducing fuel consumption and greenhouse gas emissions, as well as reducing fuel costs for consumers.

It is clear that the Australian on-road fleet exhibits a distinct fuel efficiency profile and CO_2 emissions performance as compared with Europe, the US and Japan. For instance, Australia has significantly higher mean CO_2 emission rates in grams per kilometre travelled (and thus fuel consumption). This is due to a range of factors, including lacking mandatory GHG/CO_2 emissions and/or fuel efficiency standards, a strong and sustained growth in the sales of large and heavy passenger vehicles and increased sales of diesel SUVs. The growing difference between Australia and the US, EU and Japan is even clearer when real-world emissions are considered.[4]

Australia has a long history of discussion when it comes to fuel efficiency and CO_2 emission standards for passenger and light commercial vehicle. The Australian Government has released four public consultation documents since 2008, as shown in Figure 1. A more detailed discussion of the history of Australian fuel efficiency and emission standards and comparison with international standards is provided elsewhere.[4]

Figure 1 – Previous consultation rounds in Australia.

Australia is the only country in the OECD without mandatory fuel efficiency standards for road transport vehicles, although the country has a long history with voluntary standards. For instance, voluntary fuel economy targets were adopted for new petrol cars in 1978, but were not achieved. In 2020, Australia's automotive industry announced a new voluntary reporting system and standard for CO_2 emissions reduction of 3-4% per year this decade.[5]

[4] For more information please refer to: https://www.transport-e-research.com/publications (2019f).

[5] https://www.fcai.com.au/news/index/view/news/652.

These rules are not mandatory, and the target falls short of what's needed. The use of an outdated test procedure (NEDC) as the basis for the standard is problematic, as will be discussed later.[6] But there are more issues. For instance, Australia's voluntary system allows for large road-based SUVs to fall into the same category as passenger light commercial vehicles. This may inadvertently promote sales of heavy SUVs and, as a result, increase rather than reduce fleet average real-world fuel consumption and associated emissions. A similar double standard applied in the United States. There, large passenger cars received the most lenient targets in the emission standards, which encouraged the sale of these vehicles at the expense of smaller cars, as will be discussed later. So effective policy will require a single standard for passenger vehicles – including cars and all SUVs, without exceptions.

The industry is promoting these voluntary standards as a template for Australia's new fuel efficiency rules. If voluntary standards achieved their objectives, everyone would have them, but this is clearly not the case. For instance, the EU tried voluntary CO_2 standards at the end of 1990s, but they failed to deliver.[7] Mandatory fuel efficiency (or emission) standards are now at the core of energy and transport policies around the world.[6] So adoption of a mandatory standard should be the first guiding principle of the new FES. This principle is not mentioned in Section 4 of the consultation paper.

Consultation paper question - GENERAL guiding principles: Are these the right guiding principles? Are there other principles that you think we should keep in mind?

• TER suggests that adoption of a *mandatory* standard should be the first guiding principle of the new FES.

There is ample evidence[8] that mandatory CO_2 emission or fuel efficiency standards have reduced total greenhouse gas (GHG) emissions from road transport in other countries. Indeed, mandatory CO_2 emission or fuel efficiency standards are at the core of overseas energy and transport policy.[9] The 'dumping ground' effect of not having a FES in place has been noted in Australia[10], but has also been observed in the US where car manufacturers were selling high-emitting vehicles in US states that had not adopted their own state regulation (such as the Zero Emission Vehicle Mandate) – offsetting gains in GHG emission reductions in states that did.[11]

[6] https://theconversation.com/the-road-to-new-fuel-efficiency-rules-is-filled-with-potholes-heres-how-australia-can-avoid-them-188814.

[7] *Progress in Energy and Combustion Science*, 2017, 60, 97-131.

[8] E.g. *Energy Policy*, 2017, 103, 212-222; *Environmental Science & Technology*, 2019, 53, 564-574.

[9] E.g. *Energy Economics*, 2015, 52, S41-S52; *Journal of the Assoc. Environmental and Resource Economists*, 2019, 6 (1), S37-S63.

[10] *Improving the Efficiency of New Light Vehicles, Draft Regulation Impact Statement*, Department of Infrastructure and Regional Development, December 2016

[11] *Environmental Science & Technology*, 2019, 53, 564-574.

Adoption of international vehicle emission standards (air pollutants) in Australia has historically been lagging two to seven years behind the European Union to protect the domestic motor vehicle manufacturing industry, which has now significantly declined. Despite this we are now heading for the longest ever delay in the adoption of international best practice vehicle emission (air pollution) standards: Euro 6/VI (air pollution).

The Euro Six emission standards were adopted in Europe in 2013-2014, and they appear to become effective in Australia somewhere around 2027, which means an unprecedented 14 year's delay. By that time Euro Seven will have been adopted in the EU, making Euro Six obsolete and putting Australia even further behind.

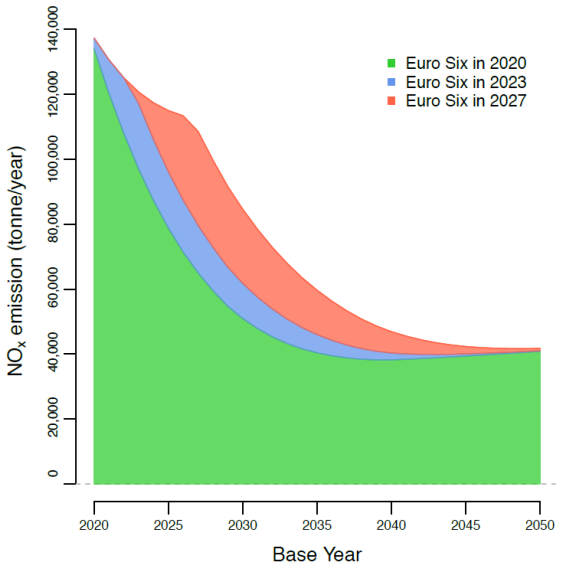

Figure 2 – Annual NO_x emissions from Australian road transport for 3 different implementation years for Euro six.[12]

This consistent delay in adopting best-practise emission standards in Australia is a significant issue as vehicles remain in the on-road fleet for many years. As a consequence, the start year for any emission legislation can impact significantly on total cumulative emissions and associated impacts on climate change and health.[12] This is shown in Figure 2 where the emission impact of different years of introduction (2020, 2023, 2027) of Euro Six is estimated. The choice of implementation year of the FES will be important in the light of cumulative greenhouse gas emissions.

Consultation paper question - GENERAL Starting emissions level limit and approach

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• The optimum level of stringency of the new fuel efficiency standards should explicitly consider the implementation date and the associated cumulative impacts on fleet average fuel consumption and GHG emissions.

Postponing the implementation of strict fuel efficiency standards – or similarly adopting weak standards – will allow more vehicles to be expensive to operate and emit higher levels of greenhouse gases and air pollutants over their useful life. TER therefore recommends adoption of sufficiently ambitious fuel efficiency standards as soon as practical, without further delay.

[12] Modelling the emission impacts of delayed Euro Six implementation in Australia: https://www.transport-e-research.com/publications (2020 b).

Consultation paper question - TECHNICAL Starting emissions level limit and approach

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• TER recommends adoption of sufficiently ambitious fuel efficiency standards as soon as practical, without further delay.

• Given slow fleet turnover and associated cumulative impacts, the long delays in achieving a mandatory and effective FES in Australia and the urgency of the climate crisis, TER recommends the FES standards be designed with a strong start.

3. The scope of the FES

Careful consideration of the scope of the new FES – what is included in and what is not – will be fundamental to successful fuel efficiency improvement and associated emission reductions. In this section a few examples are discussed to illustrate this.

The FES should (re)consider if it wants to regulate fuel efficiency or greenhouse gas emissions. Fuel efficiency and CO_2 emissions are not exactly the same as greenhouse gas (GHG) emissions. Greenhouse gases include CO_2 but other substances as well, such as methane (CH_4), nitrous oxide (N_2O), chlorofluorocarbons (CFCs) and hydrofluorocarbons (HFCs). They also include less obvious greenhouse gases such as hydrogen (e.g. leakage from hydrogen infrastructure), which has an indirect effect on climate change. The standard should, in principle, include all GHGs that are relevant for road transport. This would help prevent adverse and undesirable policy outcomes. For instance, omission of methane emission reduction policies and regulation, could indirectly promote CNG (compressed natural gas) vehicles without taking into account the issue of 'methane slip'[13] from this type of vehicles.

Although EU regulation only considers CO_2 emissions, US regulation includes additional emission standards for methane and nitrous oxide for light and heavy-duty vehicles. EU emissions regulation does include a methane emission limit for natural gas engines (heavy-duty vehicles). Regarding refrigerant (C/HFC) emissions, US regulation includes the possibility for car manufacturers to obtain 'leakage credits' for air conditioning system improvements (e.g. use of leak-tight components) or use of low-GWP refrigerants (e.g. HFO-1234yf). This option has been enthusiastically adopted overseas by several car companies.[14] So, all greenhouse gases that are relevant for road transport (CO_2, CH_4, N_2O, BC, C/HFCs) should be considered for inclusion in the Australian fuel efficiency standard – or if this is not possible, separate regulation should be considered.

Either US or EU emission or fuel efficiency regulation could be adopted in Australia, after calibration to the Australian fleet. They regulate different attributes: footprint/vehicle size (US) or vehicle mass (EU). Current Australian vehicle emission standards (air pollutants) for light-duty vehicles are based on UNECE/EU standards, so there may be a benefit in adopting EU CO_2 standards to ensure consistency in Australian emissions legislation.

[13] *Renewable and Sustainable Energy Reviews*, 2016, 66, 702-741.

[14] United States Environmental Protection Agency, EPA-420-S-19-001, March 2019.

However, TER suggests that careful consideration – and fixing of known loopholes in overseas emission regulations – is required to prevent perverse or weakened policy outcomes. For instance, it has been demonstrated in both the EU and the US that car manufacturers devise strategies and explore these loopholes to minimise compliance costs and maximise profits. This corporate behaviour means that companies comply with regulations, but do not actually improve fuel efficiency or reduce emissions, at least not to the extent intended by the regulation.[15]

For instance, US car manufactures produced flex-fuel vehicles to achieve more lenient emission standards, leading to higher emissions.[16] The "flex-fuel vehicle loophole" was so lucrative for car manufacturers that many generated large stores of surplus credits.[17] The credits allowed manufacturers to keep producing less fuel-efficient vehicles. Another distortion in the US legislation is that 'trucks' (large passenger cars) received the most lenient targets, which have encouraged the sale of more trucks at the expense of smaller cars. This also encouraged manufacturers to classify as many cars as possible as 'trucks'. A classic example is a vehicle Chrysler manufactured called the PT Cruiser. In the early 2000s, Chrysler was making large profits on its Dodge Ram pickups and wanted to sell more, but was running up against the fuel efficiency standard constraint. Chrysler responded by introducing the PT Cruiser, which looked like a car but was built on a "truck" platform, allowing Chrysler to sell more fuel-inefficient pick-ups.

TER therefore suggests that the use of credits in the FES should be prevented, whenever possible. Instead we would suggest an inversion of the credit approach. The FES could adopt a debit approach (penalties) for cases where car manufacturers are not using proven and established best practice regarding fuel efficiency in new vehicles. This would set a base from which car manufacturers can improve even further.

For the EU, 'flexibilities' in the outdated NEDC test procedure (see next section) were increasingly exploited by car manufacturers. The EU regulation allowed manufacturers to define resistances for the official test for a pre-production vehicle. Manufacturers could strip a vehicle from auxiliaries, use low-resistance and overinflated tires, use high-performance lubricants, and carefully select a favourable test track, among other options. This led to unrealistically low resistance settings (and, as a consequence, emissions) in the laboratory.

Indeed, the large and increasing difference with actual (real-world) emission rates demonstrates that emission standards can become quite ineffective, if parts of the regulation are not rectified in a timely fashion to close loopholes (e.g. replacing the NEDC with the Worldwide Harmonised Light Vehicle Test Procedure or WLTP, as was done in the EU).[18]

[15] *Environ. Innov. Soc. Transit.*, 2015, 16, 87–105.

[16] *Journal of Environmental Economics and Management*, 2012, 63, 187-207; *Environmental Science & Technology*, 2016, 50 (5), 2165-2174; *Environmental Science & Technology*, 2017, 51, 10307−10315.

[17] *Journal of the Assoc. Environmental and Resource Economists*, 2019, 6 (1), S37-S63.

[18] *Transportation Research Part D*, 2021, 90, 102666.

Consultation paper question - TECHNICAL Credit banking, transferring and pooling

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• There is evidence that credits have been used by car manufacturers to sell inefficient vehicles. Credits could be used as a loophole in the regulation if the credit rules are not carefully calibrated, regularly reviewed and updated to reflect the dynamic nature of the automotive industry. TER therefore suggests that the use of credits in the FES should be prevented, whenever possible (Section 3). If credits were to be used, the FES should incorporate a regular review and change mechanism (every 3-5 years) to ensure credits are valid and achieve their purpose.

• TER suggests an inversion of the credit approach. The FES could adopt a debit approach (penalties) for cases where car manufacturers are not using proven and established best practice technology regarding fuel efficiency in new vehicles or to penalise vehicles that are fuel inefficient with a relatively high (operational) carbon footprint (fossil fuelled vehicles). This would set a base from which car manufacturers can improve even further (a floor rather than a ceiling).

• Some technologies like engine stop-start are now mainstream and should not result in off-cycle credits. Instead an off-cycle debit could be specified in the FES for cars that do not include this technology.

• A debit or credit approach would likely need to consider vehicle characteristics such as vehicle weight, size, fuel type and purchase costs.

• Promotion of and support for low and zero emission vehicles remains important for the foreseeable future, so if the credit approach is minimised, other policy measures should be considered such as (additional) fiscal support measures and mandatory sales targets (Section 7).

4. Regulate real-world fuel efficiency and emissions

It is critical that new Australian standards reflect real-world fuel consumption and emissions as closely as possible.

A clear example how this should not be done is the continued use of an outdated legislative emission test procedure in the new FES – the NEDC (New European Drive Cycle). The NEDC laboratory emissions test is out of date and no longer used overseas due to known problems.

The use of the NEDC test procedure may sound modern, but this is deceptive. The test cycle was developed in the early 1970s resulting in a straight-line driving profile that operators follow during the emission test, as shown in Figure 3. No one drives this way. The reason for emulating this unrealistic driving behaviour was that test facilities in the 1970s could not deal with significant changes in speed, but this is not an issue anymore.

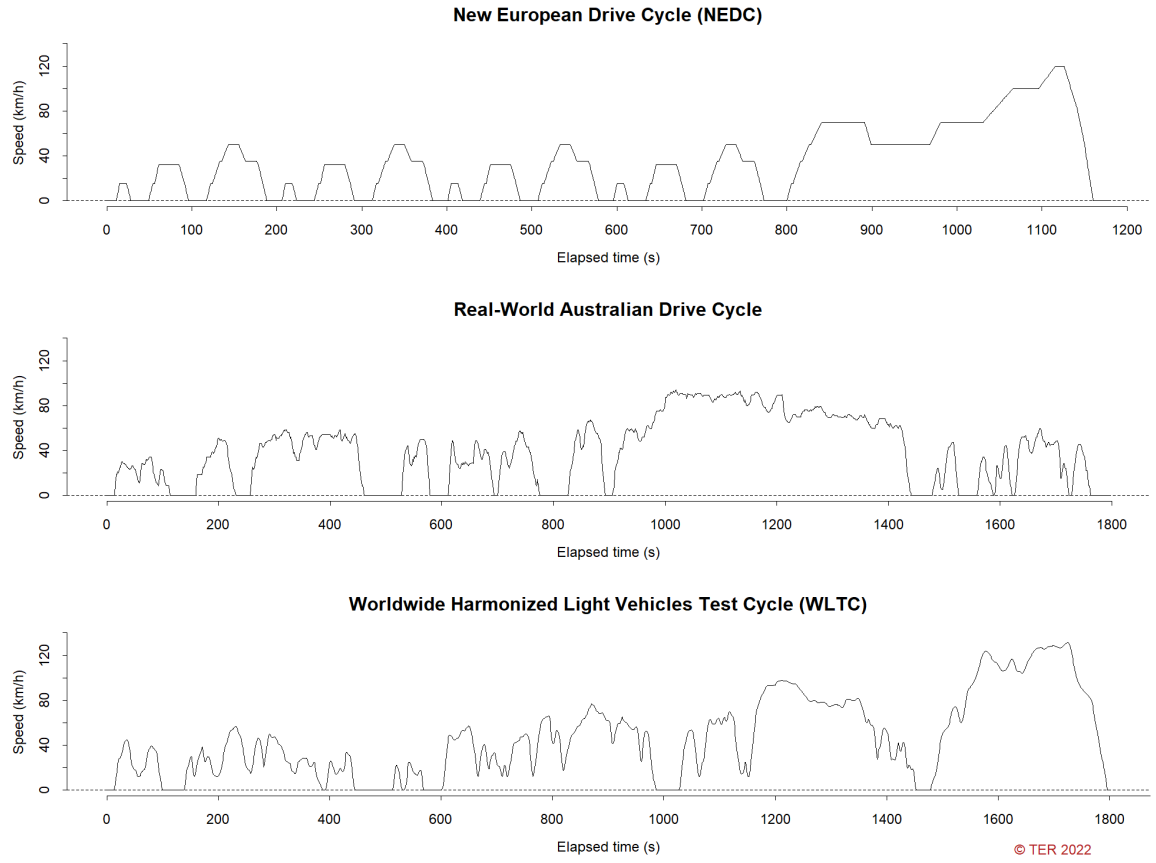

Figure 3 – NEDC versus real-world driving profiles.

The way people actually drive in the real-world is shown for comparison in Figure 3. The real-world Australian test cycle reflects actual driving data collected in Australian cities. Also shown is the Worldwide Harmonized Light-duty Test Cycle (WLTC), which replaced the NEDC and was adopted in the EU in 2017 to address the well-known issues with the NEDC.[19]

A fundamental problem is that real-world fuel consumption and emissions are increasingly higher than official NEDC figures on which the standard is based. This issue is well known, and often referred to as the 'gap'. The gap has increased over time from about 10% in 2005 to about 40% in 2015-2019, on average.[20,21]

[19] More accurately, it is not so much the WLTC, but the change to the Worldwide Harmonized Light vehicles Test Procedure (WLTP) that improved the situation. The WLTP includes the WLTC, but also removed several legal flexibilities previously used by car manufacturers in the NEDC test procedure to artificially lower emissions. An example is the use of more representative vehicle test weights, which can increase with hundreds of kilograms in the WLTP as compared with the NEDC test protocol.

[20] E.g. *Science of the Total Environment*, 2022, 832, 154943.

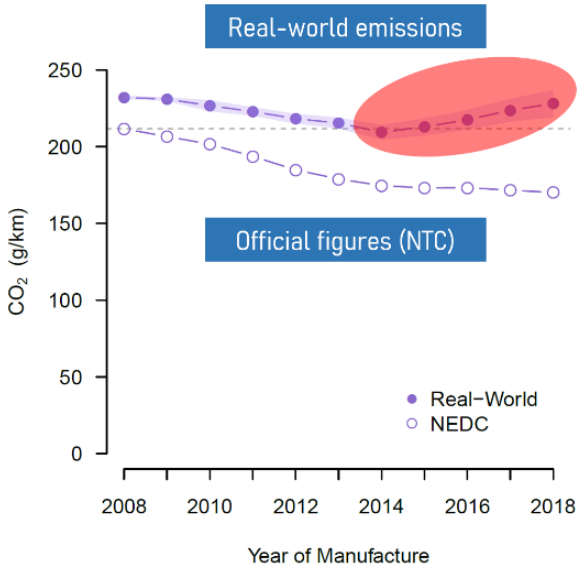

Figure 4 – Fleet average CO_2 emission rates for new Australian passenger vehicles (official NEDC based versus estimated real-world).[21]

TER research in 2019 estimated that on-road fleet-average CO_2 emissions rates (g/km) for Australian new passenger vehicles have not gone down as reported officially using NEDC figures, but are actually increasing with a few percent each year since 2015, rather than the annual reduction reported by the National Transport Commission.[21] The gap is clearly visible in Figure 4.

TER analysis found that a sustained increase in vehicle weight and a shift to the sale of more four-wheel-drive cars (in other words, SUVs and large Utes) are the main factors contributing to this undesirable outcome.[21]

So regulating and tracking Australian fuel efficiency using the NEDC test gives – and will give – the false impression that fuel efficiency is improved, where in reality this may not be the case.

To address climate change, Australia needs to make sure to have an effective FES as part of the policy toolbox, resulting in real improvements in fuel efficiency and, associated real reductions in GHG emissions, not something that just looks good on paper. Moreover, continued use of NEDC emissions data confuses the debate and undermines effective emission reduction policy and regulation. The NEDC should therefore (as a minimum) be dropped and replaced with the most recent EU or US test protocols, or even better, use of real-world emissions data only.

5. Tracking the effectiveness of the FES

Independent vehicle (on-road) emission testing will be an important aspect to track and evaluate the effectiveness of the FES in improving fuel efficiency and emissions.

A fundamental issue in Australia is a lack of sufficient and publicly available real-world emissions data for Australian vehicles since 2009. As a consequence, we do not have a good in-depth understanding of how our on-road fleet is actually performing in terms of real-world emissions.

It is therefore challenging to develop and evaluate evidence-based and cost-effective policy measures to improve fuel efficiency, mitigate greenhouse gas and air pollutant emissions from road transport. This is particularly pressing in the light of 1) internationally lagging fuel and emissions legislation in Australia, and 2) clear overseas evidence that the official (laboratory) NEDC emission test increasingly and substantially underestimates what is happening in the real-world.

[21] The research report can be found here: https://www.transport-e-research.com/publications (2019a).

Previous (small scale) Australian test programs have shown that overseas emissions data do not reflect the significant differences with the unique Australian on-road fleet. For instance, recent on-board emission testing, tunnel measurements and remote sensing in Sydney, Brisbane and Perth found relatively high emission levels in modern Australian diesel SUVs and LCVs.[22]

In a positive step, the current Federal Government has taken action on this topic. The AAA will administer a new on-road emissions testing program over the coming years, which will provide the empirical data and independent checks that Australia needs.[23] However, what is also needed as part of the FES, is the inclusion of an evaluation and correction mechanism, which will allow the Federal Government to act if the measured real-world fuel efficiency and associated GHG emissions show that actual improvements turn out to underperform or even be absent – something that is not beyond the realm of possibilities.

Figure 5 – An example of recent emission testing in Australia.[15]

Consultation paper question - GENERAL Adjustments of limit level

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• Given the risks of accelerating climate change, TER recommends the inclusion of a mechanism in the FES that allows for regular review and adjustment (e.g. every 3-5 years, or whenever deemed necessary).

A FES alone is unlikely to be sufficient to achieve significant reductions in fuel consumption and emissions. Even when the Australian FES is based on the WLTP and not the NEDC test protocol – while a definite improvement – there is still a fuel consumption gap, compared to real-world driving, which is expected to be in the order of about 20%.

[22] An overview of Australian measurement programs can be found here: https://www.transport-e-research.com/publications (2022a).

[23] https://www.aaa.asn.au/newsroom/budget-funding-for-real-world-testing-a-win-for-consumers-and-the-environment/

This means that future official WLTP based fuel use and CO_2 figures for new vehicle sales in Australia, underpinning the FES and national climate policies, will still significantly underestimate actual fuel use and GHG emissions with about 20%. So additional measures will be required to address this issue.

The EU has already considered this issue and has taken action. To ensure CO_2 emissions from road transport are actually reduced in line with EU policies and regulations and to prevent the fuel consumption gap from increasing again, separate EU regulation now requires monitoring of actual in-use fuel consumption. This means that new vehicles registered in the EU from 2021 onwards require the installation of onboard fuel consumption monitoring (OBFCM) devices.[20,24] TER argues that this will be an essential supplementary policy measure that will be required to track, monitor and report the effectiveness of the Australian FES over the coming years and to reduce the opportunity for car manufacturers here to keep exploiting legislative loopholes. TER therefore recommends that OBFCM regulation is also implemented in Australia.

Consultation paper question - TECHNICAL Information that suppliers will need to keep and supply

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• Information disclosure to the general public will be a critical aspect. The type of publicly available information that is important to achieve a minimum level of transparency regarding progress of fuel efficiency and emissions in new vehicle sales are number of vehicles sold, realistic fuel consumption and emissions (g/km) based on the WLTP and/or RDE, relevant variables that affect fuel efficiency including but not limited to tare weight, gross vehicle weight, wheels driven and rated power.

• The data and information should be released annually to the public without an expiry date.

6. Consider technology risks in the FES

There are specific risks regarding effective fuel efficiency improvements that are becoming clear from current international research work and that TER recommends should be considered in the development of the FES.

When people talk about “electric vehicles” (EVs) we normally mean battery electric vehicles (BEVs). These vehicles simply have an electric battery, which is charged from the electricity grid (power point or integrated system with solar panels) and which drives the wheels via an electric motor. There are, however, other types of electric vehicle that are already being sold or are expected, by some experts, to become more important in the future. These other EVs have different risk profiles when compared with for instance BEVs regarding effective fuel efficiency improvement and real reduction of greenhouse gas emissions. TER suggest this needs to be explicitly assessed and considered in the design and implementation of the Australian FES and supporting policies.

[24] *Transportation Research Part D*, 2021, 90, 102666.

This could be done, for example, by promoting and focussing policy efforts and regulation on robust and 'climate safe' vehicle technologies that have a higher chance of success for actual fuel efficiency improvement and GHG emissions reduction from transport. Not doing so will impose a significant risk of missing the net zero targets.

As an example, plug-in hybrid electric vehicles (PHEVs) combine an electric motor and conventional combustion engine (e.g. petrol or diesel). They have the potential to reduce global greenhouse gas emissions and local air pollution, but only if they drive mainly on electricity. Recent studies into the actual use of PHEVs have shown that electric drive is often only used for a small portion of total travel, in the order of 20% to 40%.[25] Indeed, the gap between real-world fuel consumption and the official figures is significantly larger for PHEVs.[20] The official emission test procedure typically assumes a substantially higher portion of electric drive and therefore overestimates the greenhouse gas emission benefits of PHEVs. These numbers are published and are what consumers see when they consider buying a new vehicle. Limited use of electric drive by PHEV owners, and associated higher fuel consumption per kilometre, could be considered a risk factor for this technology when compared with BEVs, which are guaranteed 100% electric with associated low emission levels per kilometre. The Australian FES should review and modify the test procedure to reflect a realistic fuel efficiency of any vehicle technology that is currently (known to be) improperly quantified.

Consultation paper question - GENERAL Design assumptions and features

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- The new FES should use a single standard for all passenger vehicles (Section 2).
- The optimum level of stringency of the new fuel efficiency standards should explicitly consider the implementation date and the associated cumulative impacts on fleet average fuel efficiency and GHG emissions (Section 2).
- The new FES should – as a minimum – not be based on the outdated NEDC test protocol and instead use the WLTP or other test procedures reflecting real-world driving behaviour (Section 3).
- The WLTP is not enough and adoption of EU OBFCM regulation should also be considered in Australia to enable adequate evaluation of real-world fuel consumption for new vehicles and ensure cost-effective climate policy for road transport (Section 5).
- The FES should include an evaluation and correction mechanism, which will allow the Federal Government to act if the measured real-world fuel efficiency and associated GHG emissions show that actual improvements turn out to underperform or even be absent – something that is not beyond the realm of possibilities (Section 5).
- The new FES should review and modify the test procedure to reflect realistic fuel efficiency and emissions for technologies with elevated fuel efficiency and climate risk profiles, e.g. PHEV (Section 6).

[25] See, for instance: https://theicct.org/publication/a-global-comparison-of-the-life-cycle-greenhouse-gas-emissions-of-combustion-engine-and-electric-passenger-cars/ and https://theicct.org/publication/real-world-usage-of-plug-in-hybrid-electric-vehicles-fuel-consumption-electric-driving-and-co2-emissions/.

7. Other policies to support the FES

To ensure effective and actual improvement in fuel efficiency and reduction in GHG emissions of new Australian passenger vehicles, the research is clear: a FES alone won't suffice. It can be easier politically to only introduce fuel economy or CO_2 emission standards, but that does not mean they are the best or only option. For instance it is generally agreed that fuel (or carbon) taxes are a substantially more effective and direct way to reduce total GHG emissions, and unusually cost-efficient (about 3-14 times cheaper), as compared with mandatory CO_2 or efficiency standards.[26] In fact, 90% of top economists prefer a fuel tax over fuel efficiency standards.[27]

So other measures than the FES are needed to complement these mandatory standards. It is not a matter of either emission standards, fiscal measures or other supporting policies. A mix of complementary policy instruments is believed to achieve optimum results. A portfolio of broad policy measures to mitigate GHG emissions has therefore been used in Europe.[28] Europe has mandatory standards, but has also implemented fiscal measures. Fiscal measures in Europe include fuel taxes to directly reduce travel and affect consumer behaviour (e.g. buying more fuel-efficient vehicles) and one-off purchase and/or annual ownership taxes to influence car purchasing behaviour, where fee levels are dependent on fuel efficiency, CO_2 emissions or related variables (e.g. engine capacity, weight, rated power). TER will discuss two examples of policy measures here that would support the FES in achieving its objectives:

- direct promotion of light vehicles, and
- fiscal measures.

Policy measures in Australia

Until recently Australia was lacking any national policy or strategy to improve fuel efficiency or mitigate CO_2 emissions from road transport, having neither mandatory CO_2 emission standards, nor any other policies in place, such as fiscal measures, road pricing or zero emission vehicle mandates (like in California) to promote electric vehicles.

The only policy measure that has been in place in Australia for quite some time is fuel economy labelling in the form of the on-line Green Vehicle Guide (https://www.greenvehicleguide.gov.au/) or GVG. However, the reported fuel economy and CO_2 emissions are based on the NEDC test. Fuel consumption and CO_2 labelling of new cars is therefore increasingly inaccurate, because of the gap discussed before. Therefore, the potential positive impact of the Guide on consumer behaviour (i.e. the purchase of more fuel efficient vehicles) is probably (and increasingly) reduced. It is likely that new vehicle buyers will undervalue fuel savings stated by the Guide, relative to other aspects such as size and performance, due to unrealistic fuel use information. A more representative test such as the WLTP or RDE (real driving emissions) may help restore public confidence in published fuel consumption and emission rates in the Green Vehicle Guide.

The recent release of the National Electric Vehicle Strategy (NEVS) is a step in the right direction, including targeted fiscal measures, electrification of the Government fleet, charging infrastructure and green loans (https://www.dcceew.gov.au/energy/transport/national-electric-vehicle-strategy).

[26] E.g. *Environmental Science & Technology, 2016*, 50 (5), 2165-2174; *Environmental Science & Technology*, 2019, 53, 564-574; *Fuel Taxation in Europe*, 2012, Springer Science + Business Media.

[27] *Journal of the Association of Environmental and Resource Economists*, 2019, 6 (1), S37-S63.

[28] *Energy Efficiency*, 2016, 9, 925-937.

7.1 – Lightweighting of new Australian passenger vehicles

The sustained and increasing proportion of large and heavy passenger vehicles in on-road fleets around the world[29] and particularly in Australia[30] has a detrimental effect on fleet average fuel efficiency and GHG emissions. SUVs and Utes are larger and heavier than conventional passenger cars and the laws of physics dictate they need more energy and fuel per kilometre of driving when compared with smaller and lighter passenger cars.[31]

We are unlikely to reach net zero in 2050 with a FES alone, while allowing the trend of ever larger and heavier vehicles to continue and this includes electric vehicles. TER expects that lightweighting and energy efficiency optimization in transport will be critical to reach significant reductions in GHG emissions and meet our targets.

Neither the US nor EU standards are designed to address this issue, for instance, by promoting the sale of more fuel-efficient smaller and lighter vehicles. In fact, there is some evidence[32] that the use of footprint or weight[33] dependent standards, may have allowed or even contributed to the trend of increasing vehicle size and weight, but more research is required in this space.

Policies that promote the sale of light (electric) vehicles could produce a substantial reduction in fuel consumption and greenhouse gas emissions from road transport, if effective. For instance, dedicated information campaigns for the general public could inform consumers about the basic principles of on-road energy use and fuel consumption and the impact of their purchasing decisions on greenhouse gas emissions and costs.

Similarly, false advertising of 'climate friendly' large and heavy vehicles (green washing) should be exposed and banned. It will be essential for car manufacturers to take responsibility for their increasing contributions to climate change. From this perspective, they should move away from marketing profitable fossil-fuelled SUVs and Utes, and instead offer and promote lighter, smaller and electric vehicles. The Federal Government can play a significant role in this discussion with the manufacturers.

[29] *Progress in Energy and Combustion Science*, 2017, 60, 97-131; *Atmospheric Environment*, 2019, 198, 122-132; US EPA-420-S-19-001, March 2019.

[30] See https://www.transport-e-research.com/publications (2019a) and also Climate Council, 2023. *Ute Beauty! The Case for Lower and Zero Emissions Utes in Australia*, prepared by H. Cheung, J., Rayner, S. Bradshaw, ISBN 978-1-922404-72-5.

[31] https://theconversation.com/we-may-be-underestimating-just-how-bad-carbon-belching-suvs-are-for-the-climate-and-for-our-health-190743.

[32] *Environmental Science & Technology*, 2016, 50 (5), 2165-2174.

[33] For instance, the NEDC allows for unrealistically low vehicle test weights, especially for large and heavy passenger vehicles. This issue has been addressed in the WLTP.

7.2 – Fiscal measures (fossil fuel carbon tax)

In isolation, mandatory fuel efficiency standards can create undesirable side-effects.

One example is called leakage, where, for example, car owners hold on to their older and less fuel-efficient vehicles for longer as the purchase price for new more fuel-efficient cars has increased.[34] This effect can be mitigated by making low or zero emission vehicles cheaper through fiscal measures and to create operational benefits (e.g. free parking).

Another example is the so-called rebound effect, where car owners incur less fuel costs due to more fuel-efficient vehicles, but then change their driving behaviour and start to drive more kilometres, offsetting or even cancelling out reduced fuel use and CO_2 emissions.[35] The rebound effect can be mitigated with additional policy measures such as a carbon (fossil fuel) tax – or, alternatively, reducing subsidies for the fossil fuel industry.[36]

Fuel and energy/electricity prices are a key factor in relation to fuel efficiency and GHG emissions. For example, low fuel prices in the US have contributed to a trend to larger and heavier high emissions vehicles – which would equally apply to Australia – whereas high fuel prices in Europe have encouraged smaller and more fuel-efficient vehicles, until recently.[37]

An increase in fuel prices will affect all other prices in the economy as a result of increased transport costs, adding to the current challenge of curbing inflation, which may be particularly detrimental to lower income households. So a fair re-distribution of fuel tax revenues is important to consider. This type of carbon tax could therefore be refined and diversified, for instance taxing climate damaging fossil fuels (petrol, diesel, LPG, CNG), while financially supporting the use of (more) climate friendly 'fuels' such as electricity generated with renewables such as solar and wind (cost neutral bonus – malus approach).

There are, of course, several public benefits of reduced fossil fuel consumption, and less energy use in transport in general, including, but not limited to, effective reduction of GHG emissions addressing climate change, reduced air pollution and associated health impacts and improved energy security.

[34] E.g. *Journal of Environmental Economics and Management*, 2012, 63, 187-207;
Journal of the Association of Environmental and Resource Economists, 2019, 6 (1), S37-S63.

[35] E.g. *Energy Economics*, 2015, 52, S41-S52; *Annual Reviews of Environment and Resources*, 2014, 39, 393-418.

[36] E.g. *Energy Efficiency*, 2016, 9, 925-937.

[37] *Fuel Taxation in Europe*, 2012, Springer Science + Business Media.

Consultation paper question - TECHNICAL Multiple targets

• To be effective, the new FES should use a single standard for all passenger vehicles. This is particularly relevant as TER modelling predicts that about 70% of the on-road passenger fleet will be SUVs in 2035, suggesting a continued shift in sales towards more lenient standards, if separate standards were used for SUVs and cars (Section 2).

• All greenhouse gases that are relevant for road transport (CO_2, CH_4, N_2O, BC, C/HFCs) should be considered for inclusion in the Australian fuel efficiency standard – or if this is not possible, separate regulation should be considered (Section 3).

• A FES will not work effectively in isolation and implementation of other supporting policy measures and regulation will be essential to achieve the objectives of the FES and climate policy in Australia. Examples are legal requirements for onboard fuel consumption monitoring (OBFCM) devices in new vehicles (similar to current EU Regulation, Section 5) and direct promotion of light vehicles and fiscal measures such as a fossil fuel tax (Section 7).

Consultation paper question - TECHNICAL Attribute-based emissions limit curve

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• Australia is unlikely to develop a new FES from scratch and adoption of the relevant EU Regulation may be the best option to ensure consistency with current Australian emission standards for air pollutants. However, modification of EU regulation should be considered to learn from overseas experience and close loopholes that could be explored by vehicle manufacturers and undermine the effectiveness of the FES (Section 3).

8. Concluding remarks.

Australia is long overdue for a mandatory fuel efficiency standard. Three rounds of consultation by the Federal government over the last 15 years have not achieved a tangible outcome, so it is time.

Australia is unique with its use of voluntary standards, since mandatory - not voluntary - CO_2 emission or fuel efficiency standards are at the core of energy and transport policies around the world. The voluntary standards of the past have failed and have not achieved significant fuel efficiency improvements and greenhouse gas emission reductions on Australian roads and overseas. Therefore the new standard has to be mandatory, in line with international best practice.

To create a cost-effective FES. various aspects need to be considered carefully. The devil will be in the detail. If it is going to be more than a paper exercise and we want to achieve real improvements in fuel efficiency and real reductions in greenhouse gas emissions from road transport, the Government has to ensure the new standards are effective and properly designed. We should learn from past experience in the EU and US and modify the Australian FES to address the known issues with similar standards overseas.

There are several pitfalls and aspects that will need to be carefully considered. This report has pointed to a few important ones:

- Stop using the outdated and problematic NEDC test protocol and use the WLTP.
- Use a single standard for all passenger vehicles.
- Support the FES with other policies and regulations such as on-board fuel consumption monitoring (OBFCM regulation), direct promotion of light vehicles and a carbon tax on fossil fuels (e.g. cost neutral bonus-malus system).

An ineffective or diluted FES and the absence of supporting measures could be worse than having no FES. If the FES is not carefully designed, it may give the appearance we are improving fuel efficiency and reduce emissions, but in reality this is not the case, undermining effective climate action.

TER suggests full transparency of the FES development process to the general public, and further consultation with independent experts on the FES.